

H13 Steel Microstructure After Quenching

Pearlite, bainite and martensite measured in H13 blocks quenched in vacuum, gas, salt, oil and polymer, set beside the MC carbide precipitation at the austenite grain boundaries for each quench. A reference summary of published practice and not an Aobo Steel specification.

Reference only. The microstructure percentages and the MC grain boundary precipitation figures are reproduced from the source named at the foot of this sheet. They are a published reference rather than a recommendation of ours, and the sheet carries no tolerances. Read them against the section thickness, the quench medium and the furnace actually available before a heat treatment cycle is set on them.

Pearlite, bainite and martensite by quench medium

Source, matrix microstructures produced as a function of quenchant for the two extreme H13 steel block sizes, Table V, printed page 2-16 of the report (PDF page 33).

Quench medium	2 inch cube surface	2 inch cube mid-radius	14 inch cube surface	14 inch cube mid-radius
Vacuum	28B 72M	28B 72M	13P 72B 15M	14P 72B 14M
Nitrogen	16B 84M	16B 84M	42B 58M	42B 58M
Helium	13B 87M	13B 87M	38B 62M	38B 62M
Low speed oil	7B 93M	7B 93M	26B 74M	30B 70M
Fluidized alumina	5B 95M	5B 95M	23B 77M	29B 71M
High speed oil	2B 98M	2B 98M	15B 85M	27B 73M
30% UCON A solution	100M	1B 99M	8B 92M	26B 74M
10% UCON A solution	100M	100M	100M	25B 75M

B is bainite, M is martensite and P is pearlite, and the amounts inside each cell are percentages. The report states that the surface and the mid-radius of the 2 inch block are essentially identical. The gas figures are for nitrogen and helium at 2 atm with a gas velocity of 3,400 ft per minute. A reference table only, it is not an Aobo Steel recommendation.

MC grain boundary precipitation by quench medium

Source, MC grain boundary precipitation as a function of quenchant for the two extreme H13 steel block sizes, Table IV, printed page 2-15 of the report (PDF page 32).

Quench medium	2 inch cube surface	2 inch cube mid-radius	14 inch cube surface	14 inch cube mid-radius
Vacuum	91	91	98	98
Nitrogen	74	74	94	96
Helium	68	68	92	96
Low speed oil	50	52	64	94
Salt at 750 °F	45	50	55	94
Fluidized alumina	44	48	51	94
Salt at 575 °F	28	41	32	94
High speed oil	13	35	16	93
30% UCON A solution	0	27	0	92
10% UCON A solution	0	16	0	92

Figures are on the 0 to 100 scale the report uses, where a higher number means more MC carbide precipitation at the austenite grain boundaries. The two salt bath entries appear in this table only, and the 575 °F bath is the faster of the two. A reference table only, it is not an Aobo Steel recommendation.

Aobo Steel, tool steel supplier

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Reference data compiled from Improved Life of Die Casting Dies of H13 Steel by Attaining Improved Mechanical Properties and Distortion Control During Heat Treatment (J. F. Wallace and D. Schwam, US Department of Energy final report DOE/ID/13320-3, October 1998). The MC grain boundary precipitation table is printed on page 2-15 and the matrix microstructure table on page 2-16 of that report. Both were read from the page images and not from an automatic text layer.

CONTACT

EMAIL
sales@aobosteel.com

WHATSAPP
+86 180 6294 5370

WEB
aobosteel.com



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